

All Regional Engineers

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Special Provision for Lime Stabilized Soil Mixture

January 13, 2006

This special provision was developed by the Bureau of Materials & Physical Research to update the material specifications for lime and to add a requirement for subgrade stability. It has been revised by the Geotechnical Unit in the Bureau of Bridges and Structures to require 95 % compaction of the soil prior to stabilization and to ensure the stability of the soil below the stabilized soil complies with the Department's "Subgrade Stability Manual".

It should be inserted into all contracts using a lime stabilized soil mixture.

The districts should include the BDE Check Sheet marked with the applicable special provisions for the April 28, 2006 and subsequent lettings. The Project Development and Implementation Section will include a copy in the contract.

This special provision will be available on the transfer directory January 13, 2006.

80133m

LIME STABILIZED SOIL MIXTURE (BDE)

Effective: November 1, 2004

Revised: April 1, 2006

Revise Section 310 of the Standard Specifications to read:

“SECTION 310. LIME STABILIZED SOIL MIXTURE

310.01 Description. This work shall consist of the construction of a lime stabilized soil mixture, composed of soil, lime, and water which shall be considered as subbase.

310.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Water.....	1002
(b) Hydrated Lime.....	1012.01
(c) By-Product, Non-Hydrated Lime (Note 1)	
(d) Lime Slurry (Note 2)	
(e) Soil (Note 3)	
(f) Bituminous Materials (Note 4).....	1009.07, 1009.08, 1009.09

Note 1. By-product, non-hydrated lime (lime kiln dust) shall conform to the following requirements:

Parameter	Value
Total calcium and magnesium oxides (nonvolatile basis)	60 % minimum
Available calcium hydroxide (rapid sugar test, ASTM C 25) plus total MgO content calculated to be equivalent Ca(OH)_2	30 % minimum
As received loss on ignition (carbon dioxide plus moisture, combined and free)	40 % maximum
Free water (as received basis)	4 % maximum
SO_3	10 % maximum

The sieve analysis of the lime residue shall be as follows:

Sieve	Maximum Percent Retained
4.75 mm (No. 4)	5
600 μm (No. 30)	10
150 μm (No. 100)	30

Note 2. The lime used in the slurry shall be either hydrated lime conforming to the requirements of ASTM C 207, Type N, or quicklime conforming to the requirements for calcium lime as stated in ASTM C 5. The quantity of lime (hydrated lime or quicklime) in

the slurry shall be a minimum of 35 percent and a maximum of 45 percent by total mass (weight) of slurry.

Note 3. The soil shall have a minimum clay content of 15 percent, determined according to AASHTO T 88; and shall have a maximum organic matter content of ten percent, determined according to AASHTO T 194. It shall also be a reactive soil. A reactive soil is defined as a soil which when mixed thoroughly with at least three percent lime and then compacted and cured for 48 hours at 49 °C (120 °F), will exhibit a compressive strength gain of at least 345 kPa (50 psi) greater than that obtained from similarly prepared untreated control specimens. The compressive strength will be determined according to AASHTO T 208.

Note 4. The bituminous materials used for curing shall be emulsified asphalt RS-1, RS-2, CRS-1, CRS-2, HFE 60, HFE 90, or HFE 150; rapid curing liquid asphalt RC-70 or RC-250; or medium curing liquid asphalt MC-70 or MC-250.

310.03 Equipment. Equipment shall meet the requirements of the following Articles of Section 1100 - Equipment:

Item	Article/Section
(a) Rotary Speed Mixer	1101.06
(b) Disk Harrow (Note 1).....	1101.02
(c) Distributor (Note 2)	
(d) Lime Slurry Equipment (Note 3)	

Note 1. A disk harrow may be used when permitted by the Engineer.

Note 2. The distributor shall be of a mechanical type and shall be approved by the Engineer.

Note 3. The equipment used for mixing, transporting, slaking, and placing lime slurry shall be approved by the Engineer.

310.04 Proportioning. Proportioning shall be as follows.

- (a) Samples. Samples of the lime and the project soil(s) shall be obtained and submitted to the Engineer at least 45 days prior to the construction of the lime stabilized soil mixture. Sample sizes shall be a minimum of 12 kg (25 lb) for the lime and 90 kg (200 lb) for the project soil(s).
- (b) Mix Design. The actual proportions of lime, soil, and water will be determined by the Engineer prior to construction using the submitted samples. The Engineer reserves the right to make such adjustments in proportions as are considered necessary during the progress of the work.

In no case shall proportions or type of lime be changed during the progress of the work without permission by the Engineer.

CONSTRUCTION REQUIREMENTS

310.05 General. The lime stabilized soil mixture shall be constructed when the temperature of the soil measured 150 mm (6 in.) below the surface, is above 10 °C (50 °F), and the ambient air temperature in the shade is above 7 °C (45 °F).

The quantity of lime stabilized soil mixture constructed shall be limited to that which can be covered by the succeeding pavement layer during the same construction season.

310.06 Preparation of Subgrade. The area to be processed shall be shaped to the proper grade and cross section. All vegetation and other objectionable material shall be removed from within the limits of lime treatment. In cut or at grade sections, the subgrade shall be prepared according to Article 301.03; except the minimum immediate bearing value (IBV) of the soil below the soil to be stabilized, shall be 3.0.

310.07 Application of Lime. The lime (slurry or dry) shall be applied uniformly on the soil. The application of lime shall be limited to that area where the initial mixing operations can be completed during the same working day.

After application of dry lime, but before the addition of any water, the surface of the subgrade shall be lightly scarified or disked. When lime slurry is used, the surface of the subgrade shall be lightly scarified or disked prior to application of the slurry.

Dry lime shall not be applied when wind conditions are such that blowing lime becomes objectionable to adjacent property owners or creates a hazard to traffic on adjacent highways, as determined by the Engineer.

Lime slurry shall be applied within 30 days of preparing and mixing the slurry, and shall be thoroughly agitated prior to application.

Lime (slurry or dry) that has been exposed to the open air for a period of six hours or more shall be replaced. Lime (slurry or dry) which has been damaged by hydration due to rain prior to or during the mixing operations, or has been displaced by the Contractor's equipment or other traffic after application shall be replaced.

310.08 Mixing. Mixing shall be performed in two stages as follows:

- (a) Initial Mixing. The lime, soil, and water shall be thoroughly mixed until a uniform mixture throughout the required depth and width is obtained. All clods and lumps shall be reduced to a maximum size of 50 mm (2 in.). The moisture content of the stabilized soil shall be between optimum and three percent above optimum.

After mixing, the surface shall be sealed with a light rolling. The mixture shall then be left to undergo a conditioning period of at least 48 hours. The mixture shall be maintained in a moist condition throughout the entire conditioning period.

- (b) Final Mixing. After the required conditioning period, the mixture shall be uniformly mixed and maintained at approximately optimum moisture content. If the mixture contains clods, they shall be pulverized to meet the following requirements:

Sieve Size	Minimum % Passing
25 mm (1 in.)	100 %
4.75 mm (No. 4)	60 %

Mixing may be performed in a single stage when permitted by the Engineer, provided that the final mixing requirements are met.

310.09 Compaction. After final mixing, compaction shall be completed within the same working day.

The compacted, lime stabilized soil mixture shall have a minimum dry density of 95 percent of the laboratory standard dry density. The in-place dry density will be determined according to AASHTO T 191, or Illinois Modified AASHTO T 310 (Direct Transmission Density/Backscatter Moisture). The laboratory standard dry density will be determined according to AASHTO T 99.

310.10 Finishing and Curing. When compaction of the lime stabilized soil mixture is nearing completion, the surface shall be shaped to the required lines, grades, and cross section shown on the plans. For bituminous concrete base course and pavement (full-depth) and portland cement concrete base course and pavement, the surface of the lime stabilized soil mixture shall be brought to true shape and correct elevation according to Article 301.06, except that well compacted earth shall not be used to fill low areas. The surface shall be maintained in a moist condition by means of a fine spray during all finishing operations.

The lime stabilized soil mixture shall be cured for a period of seven days and maintained at optimum moisture content by sprinkling with water or applying bituminous materials according to Article 312.19. During this period, no equipment or traffic will be permitted on the completed work beyond that required for maintenance of curing.

310.11 Subgrade Stability. Following curing, the Engineer will determine the stability of the lime stabilized soil mixture in terms of the immediate bearing value (IBV) according to Illinois Test Procedure 501. The IBV shall be a minimum of 23.0.

No equipment or traffic shall be on the lime stabilized soil mixture after compaction until the required IBV is attained.

310.12 Construction Joints. Construction joints will not be required between each day's work unless there is a time lapse of seven days or more between the processing of adjacent sections. When construction joints are required, they shall be formed by cutting back 1 m (3 ft) into the completed work to form a vertical face. Otherwise, damage to completed work shall be avoided.

310.13 Maintenance. The lime stabilized soil mixture shall be maintained in a manner satisfactory to the Engineer. Maintenance shall include immediate repairs of any defective or damaged portions.

310.14 Method of Measurement. This work will be measured for payment as follows.

- (a) Contract Quantities. The requirements for the use of contract quantities shall conform to Article 202.07(a).
- (b) Measured Quantities. Processing lime stabilized soil mixture will be measured for payment in place and the area computed in square meters (square yards). The width of measurement will be as shown on the plans.

Lime will be measured for payment in metric tons (tons). The lime will be measured in trucks or freight cars. The Contractor shall furnish or arrange for use of scales of a type approved by the Engineer. When the lime is shipped in trucks, it will be measured at the place of loading, at the place of unloading, or at such other place as the Engineer may designate. The Engineer may accept original signed freight bills in lieu of determining the mass (weight).

Should the Contractor's method of construction require additional earth excavation or embankment due to requiring more than one lift to construct the lime stabilized soil mixture as shown on the plans, this extra earth excavation and embankment will not be measured for payment.

310.15 Basis of Payment. This work will be paid for at the contract unit price per square meter (square yard) for PROCESSING LIME STABILIZED SOIL MIXTURE, of the thickness specified; and per metric ton (ton) for LIME."